Financial & Technological Literacy and Stock Market Participation

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Brynn Saunders

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Morris Kleiner, Professor	Date, oral presentation	Date, paper completion
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Steve Kelley, Senior Fellow		Date

I. Introduction

Why do fewer than fifty percent of Americans invest in the stock market, given the historically high rate of return on equity? Over the past hundred years, equities have averaged about 6% more than the return on short-term Treasury bills (Mehra and Prescott, 1985). Limited investment in equities, combined with unawareness about how to save, and blind faith in social security and pension plans, will result in many Americans having insufficient funds for retirement. Today, it is estimated that less than 50% of Americans hold stock (see Figure 2). With changes in the pension landscape increasingly thrusting responsibility for saving and investing onto workers and retirees, financial literacy is integral to accumulating wealth sufficient for retirement (Lusardi & Mitchell, 2013). Lusardi and Mitchell (2013) have gone so far as to say that financial literacy can explain more than half the wealth inequality observed in U.S. data.

With the impetus on saving for retirement placed on individuals – not employers – being able to use and understand the Internet becomes imperative since, increasingly, entities are using the Internet to provide financial education, including information and training materials, practical tools such as budget worksheets and loan and retirement calculators, and interactive financial games (GAO Financial Literacy, 2014). Without accessing and understanding these tools – which require both technological literacy and a moderate amount of financial sophistication – consumers may be missing out on the high return of equities, thereby harming their ability to accumulate wealth and save for retirement.

Economists have struggled to solve the "equity premium puzzle" – the puzzle being that consumers' aversion to risk would have to be implausibly high to substantiate their reluctance to invest in equities, suggesting that other factors are in play. To help explain consumers'

reluctance, economists have hypothesized that various costs act as inhibitors to participation. These costs of participating in the stock market include information costs, fixed and variable transaction costs, and limited access, among others. Additionally, various demographic and socioeconomic factors, such as age, education, income, level of financial sophistication, and Internet usage, can act as inhibitors to stock market participation.

Of these myriad costs or inhibitors, technological (used interchangeably with Internet/web literacy for our purposes) and financial literacy seem to be two intriguing areas to examine for a potential relationship with stock market participation. The basic premise of this research is that once people can access and navigate the web and its wealth of information, and learn about basic financial principles, they will understand the potential rewards (and risks) of investing in equities, and (likely) be able to accumulate wealth at a higher rate than they could without exposure to equities.

Although income is an important component of financial security, perhaps the most critical determinant of financial well-being is the accumulation of wealth. As household financial well-being is increasingly determined by the ability of family members to make complex financial decisions, policymakers are concerned that a substantial proportion of consumers lack basic financial knowledge and money-managing capacities, which are integral in ensuring and enhancing the financial well-being of their families (Schmeiser & Seligman, 2013). Lusardi and Mitchell (2007) posit that differences in planning behavior help explain why household retirement assets differ, and why some people cross the retirement threshold with very little (or no) wealth. Without the tools to plan, of which Internet savvy and financial literacy are significant, consumers are left with a “too little, too late” prognosis when it comes to their retirement savings. And, given the high historical returns on equities, on average, exposure to

stocks as an element of one's financial portfolio should be considered. The problem is that too often, stocks are not being considered, as evidenced by the low participation rate via limited knowledge about basic financial principals and limited sophistication about the most important informational resource: the Internet.

We test our hypothesis using an econometric model with data from the Health and Retirement Study, a survey administered by the University of Michigan. After testing our model, the results do not show a statistically significant relationship of technological literacy with stock market participation or a statistically significant relationship of financial literacy with stock market participation. Despite the inconclusive results of our variables of interest, this research has value nonetheless because it gives credence to the unclear interaction between financial literacy, technological literacy, and stock market participation. Furthermore, although our regression results do not point to a statistically significant interaction between our variables of interest and stock market participation, the raw numbers hint that there may exist some relationship. It must be acknowledged, however, that the directionality of the interaction is unclear, especially with regard to stock market participation and financial literacy. In other words, it is difficult to interpret any association between the two variables as a causal effect due to simultaneity bias: in addition to the notion that boosting financial literacy could increase stock market participation is the equally valid notion that participating in the stock market could boost financial literacy. Finally, notwithstanding the ambiguous results of this research, it is helpful to explore several policy options that exist in the hope of increasing financial and technological literacy, and how Americans can strive toward ensuring a healthier financial outlook.

II. Literature Review

Ascertaining the drivers of limited stock market participation has intrigued economists for decades, in large part due to Mehra and Prescott's (1985) concept of the equity premium puzzle, as mentioned above. Research into the subject has suggested that participation is a function of a variety of factors, including age and education (Bertraut, 1998), risk aversion (Campbell and Cochrane, 2000), entry costs (Alan, 2005), social interaction (Hong et al., 2004), trust in financial institutions (Georgarakos and Pasini, 2011), home ownership (Vestman, 2013), and social capital (Guiso et al., 2004), in addition to others.

Internet usage (Bogan, 2008) and financial literacy (Rooij et al., 2011) have also been shown to play a role in stock market participation. Bogan, in her 2008 journal article, suggests that households that are more comfortable using the Internet participated substantially more than households that are less comfortable using the Internet. In terms of the probability of participation, Bogan found that using the Internet (defined as the head of household indicating that he/she used the Internet at home or work) was equivalent – according to Bogan's probit model coefficients – to having over $27,000 in additional household income or over two more mean years of education.

It is often easy for some segments of the population to take for granted access to and adeptness of using the Internet and data shows that older, less educated, poorer, and rural populations have lower Internet user rates (Seattle Goodwill, 2014). In today's world, people who have the skills and digital literacy to take advantage of technology's potential are more ready not only for work and education but also for acquiring knowledge of our increasingly complex financial landscape. Many financial institutions are going paperless, opting to send financial statements, reports, tips, and prospectuses via email. Moreover, *free* online courses

(Coursera, edX, Khan Academy) offer lessons and guidance in economics, finance, and mathematics from top schools around the world but are only able to be accessed by people with a base level of technological literacy. Without the knowledge of how to navigate, interact, and comprehend the Internet, basic lessons about interest rates, inflation, compound interest, and risk diversification go unlearned.

In 2013, former FCC Chairman Julius Genachowski said approximately one in three Americans, or 100 million people, still do not have broadband in their homes, with low-income Americans and minorities disproportionately on the wrong side of the digital divide (Levere, 2013). Over the next decade, nearly 80 percent of jobs are projected to require digital skills (Levere, 2013). Whether we like it or not, all things are headed toward the digital age: an economy based on information computerization, including our financial markets, which are becoming increasingly complex. Yet embracing the informational wonder of the Internet does not come without caution, especially when the Internet is used as a teaching mechanism. Dreyfus (2013) has noted that if we want to teach skill in particular domains via the Internet, learners must be committed enough to turn information into knowledge.

Financial literacy, which some view as a type of investment in human capital (Lusardi & Mitchell, 2014), seems to have large consequences on the ability to manage retirement savings. There is also evidence that financial literacy has an influence on stock market participation. Rooij and his co-authors concluded that a lack of understanding of economics and finance is a significant deterrent to stock ownership, and that those who have low financial literacy are significantly less likely to invest in stocks (Rooij et al., 2011). Furthermore, those who are not financially literate are less likely to plan for retirement and to accumulate wealth (Rooij et al., 2011). As Friedberg (2013) observes, a lack of knowledge about basic financial principles

appears to have real consequences. One study compared the wealth and investment patterns of people who had received financial education at work with the patterns of those who had not, finding that financial education was associated with higher savings and higher wealth (Lusardi, 2004). Such findings suggest that educating people about retirement planning (via online tools or otherwise) can make a difference in how well they carry out their plans.

The Great Recession was undoubtedly exacerbated by uninformed consumers. As Harnisch (2010) notes, the "divergence between more complex consumer decisions and financial illiteracy has led to a rising trend of suboptimal, often unsustainable consumer behaviors, resulting in record-high levels of debt and record low-levels of economic security for individuals, families and communities throughout the nation." Harnish also argues that financial literacy is integral to the market economy, since educated consumers are better able to demand products that meet their short- and long-term financial needs, with providers competing to create products whose characteristics best respond to those demands (2010).

Hilgert, Hogarth and Beverly (2003) have noted that increased interest in financial education has been prompted by the increasing complexity of financial products and the increasing responsibility on the part of individuals for their own financial security. The authors argue that a basic financial education is important not only to individual households and families but to their communities as well, since knowledgeable consumers who make informed choices are essential to an effective and efficient marketplace.

Lusardi and Mitchell found that survey respondents who were deemed financially literate (correctly answering questions regarding compound interest, inflation, and risk diversification) were more likely to plan and to succeed in their planning, and rely on formal methods such as retirement calculators, retirement seminars, and financial experts, instead of family/relatives or

co-workers (Lusardi and Mitchell, 2011). Although the authors acknowledge that the direction of causality is unclear (those who were more likely to utilize financial planning tools could also be deemed more financially literate), they nonetheless suggest that those who report that they are unable to plan for retirement and/or who cannot carry out their retirement saving plans are also those who are least aware of fundamental economic concepts driving economic wellbeing over the life cycle (Lusardi and Mitchell, 2011).

To make matters worse, workers seem to know very little about their Social Security and pension benefits, two of the most important components of retirement wealth (Lusardi and Mitchell, 2011). Close to half of workers could not report their type of pension plan, and an even larger portion was ignorant of future Social Security benefits (Lusardi and Mitchell, 2011). And the trend of financial illiteracy is increasing as the financial marketplace has become more complex; "today's workers require greater financial sophistication to manage their retirement savings" (Murphy, 2013). The fraction of workers at risk of having inadequate funds to maintain their lifestyle through retirement is estimated to have increased from 31% to 53% from 1983 to 2010 (Benartzi & Thaler, 2013).

People who lack financial literacy most often reside in distressed communities and are less able to distinguish between financial products or understand the implications of the transactions into which they are entering (Servon and Kaestner, 2008). The ubiquitous use of financial jargon also acts as a mechanism that encourages exclusivity. One commentator remarked that when it comes to discussing money, incomprehension is a form of consent (Lanchester, 2014). In other words, we can't object to what we don't understand. If we allow ourselves not to understand the language of money, we are signing off on the way the world works today – in particular, we are signing off on the prospect of an ever-widening gap between

the rich and everyone else (Lanchester, 2014). In short, Americans are failing to meet existing financial demands, engage in little or no planning for future events and potential emergencies, have modest knowledge of their current financial portfolio, and do not have an acceptable understanding of the financial decision-making process (Harnisch, 2010).

Furthermore, financial literacy, the digital divide, and other issues that separate disadvantaged groups from the financially savvy make it difficult for low- and moderate-income individuals to reap the potential benefits associated with electronic banking (Servon and Kaestner, 2008). Low- and middle-income groups stand to gain a great deal from financial and technological literacy and electronic banking but are consistently excluded from the benefits these advances offer (Servon and Kaestner, 2008). Despite the substantial potential for accurate and efficient service, few have an interest in either the low-income consumers' policy concerns or in the reasonable and equitable treatment of the low-income user (Leymaster, 1980). Electronic banking offers convenience, control, and a way to monitor real-time spending and service or interest fees. Yet, electronic banking holds a fading hope for the low-income consumers of this nation; the poor are likely to be the last and most poorly served by electronic banking (Leymaster, 1980).

The disadvantaged are mostly excluded from the world of electronic banking, which includes access to powerful planning and forecasting tools, and teaching modules about basic financial concepts, such as interest rates or inflation. In this way, technology can operate as a powerful hook to get low- and middle-income individuals to the table to learn about financial literacy (Servon and Kaestner, 2008), especially since research has shown a potentially powerful connection between technological literacy and financial literacy (Servon and Kaestner, 2008). If we accept the notion that the ability to use the web enables users to access a powerful tool for

financial literacy, then it is possible that increasing technological literacy and financial literacy in tandem will yield consumers that have the ability to make informed judgments and take effective actions regarding the current and future use and management of money (Harnisch, 2010). With greater financial literacy, enabled and increased by the use of the Internet, Americans will be exposed to a greater range of saving and investment vehicles, including equities. It is possible, then, that a certain percentage will be drawn to invest a portion of their assets in the stock market, due to the simple fact that no other asset has returned more, on average, over the long-term.

Of course, one cannot invest in the stock market without assets to do so, but Banerjee and Duflo (2007) found that although wealth plays a large role in stock market participation, even the poor have surplus money to save or invest. And it is critical to note that investing in the stock market is not the best decision for every household; emergency funds and employer sponsored plans that match employee contributions should be funded first. But, for many households with available funds, investing in stocks could be a part of their portfolio. Although we cannot be absolutely sure that all those who should be in the stock market are, it is reasonable to assume that a large share are not due to the anemic participation rate of under fifty percent.

That said, saving money is hard because it requires people to override a natural tendency to prioritize the present over the future (Karlan, 2010). Moreover, risk aversion is a strong psychological factor that can potentially yield large economic deficits. People are naturally more averse to losing things than they are inclined to gaining things (Karlan, 2010). In studying respondents' answers to the Survey of Consumer Finances, Lusardi and Mitchell (2011) found that a large majority (more than 60 percent) stated they are unwilling to take *any* financial risk. This may be due not only to strong risk aversion, but also to the fact that many respondents feel

they simply do not understand risk diversification. The capital asset pricing model (CAPM), in general terms, is the theoretically appropriate required rate of return on an asset, given that the required return is equal to the sum of the risk-free rate or the time value of money (e.g., 90-day treasury bills) plus the risk premium, which is equal to the beta of the asset (the sensitivity or risk measure arising from exposure to market movements) multiplied by the market premium (the difference between the expected market rate of return and the risk-free rate of return). The beta of an asset is important because it measures risk that exists above and beyond diversifiable risk. That is, the beta risk is inextricably tied to the expected return. And so goes the old adage: no risk, no return.

Even though more sophisticated versions of the CAPM exist, it remains popular due to its simplicity and utility. As Perold (2004) notes, the Capital Asset Pricing Model will tell us how investors determine those expected returns—and thereby asset prices—as a function of risk. Yet there are lots of investors who hold undiversified portfolios that are likely taking risks for which they are not being rewarded (Perold, 2004). Ensuring basic financial literacy could make strides toward facilitating investments that are commensurate with a household's goals and their comfort level of risk. The key point here is that knowledge opens up possibilities, so consumers can make informed decisions about their finances, not be left hoping and guessing.

Most, if not all, of the literature has measured equity participation to mean holding stock directly or indirectly (through mutual funds); therefore 401k accounts and other sponsored retirement accounts are not included. This fact is a notable qualification to this research, since the data that is used in this paper also uses the measure of stock participation to mean holding stock above and beyond employer-sponsored retirement accounts. Yet, the participation rates even when defined contribution plans *are* included are puzzling: less than 50% of Americans

hold stock (see Figure 2). Furthermore, of those who do hold stock, more than 90% is held by Americans in the top 10th percentile (see Figure 1). Given the expected retirement shortfalls that will befall low- and middle-class Americans, combined with their relatively low levels of technological and financial sophistication, and limited participation in equity markets, the relationship between technological literacy, financial literacy, and stock market participation seems ripe for examination.

III. Assumptions and Theory

The major assumption of our research is that the historically high rates of return on equity will hold true for projections, thereby those who participate in the stock market will, with diversification and a long-term approach, realize high returns well into the future. Another assumption is that all investors have access to the same information at the same time. Our theory posits that if consumers are technologically and financially literate, they will have the same access to the same information about financial markets as everyone else, but this is not true in real markets, due to insider trading and information asymmetry. Furthermore, we assume that consumers are rational, want to maximize their wealth, and that even poor Americans have some money to invest.

IV. Methodology

We test our hypothesis using cross-sectional data from the 2002 Health and Retirement Study (HRS), conducted by the University of Michigan. The HRS is a survey conducted every two years since 1992, on a representative sample of more than 20,000 Americans over the age of 50. Although the survey is administered every two years, certain questions have only been asked during a certain year's survey, in an "experimental module." Respondents that were surveyed

about all three of our variables of interest – financial literacy, technological literacy, and stock market participation – last took place in 2002. By measuring how the dependent variable that measures stock participation is correlated with our independent variables technological and financial literacy, we can interpret the relationship of these two factors. Technological literacy is used interchangeably with web literacy, but technically the survey question defined in this research as technological literacy asks about respondents' frequency of using the Internet (see Appendix 1).

We use a linear probability model and a logit model with odds to test our hypothesis. Our dependent variable is a binary variable for stock market participation. Our independent variables are financial and technological literacy, along with control variables for age, education, and income.

$$stock\_part_i = \beta_0 + \beta_1 fin\_lit_i + \beta_2 web\_lit_i + \beta_3 age_i + \beta_4 edu_i + \beta_5 income_i + \varepsilon_i$$

where:

- $stock\_part_i$ is a dummy variable where we assign a value of 1 if the household owns any shares of stock or stock mutual funds, and 0 if it does not.
- fin_lit is a proxy for financial literacy, as measured by answers to three questions regarding 1) compound interest, 2) inflation, and 3) risk diversification. Correct answers are assigned a value of 1; incorrect answers are assigned a value of 0. The scale is an ordinal-level index where each correct answer is scored as a single point. A respondent may receive a maximum of one point for each correctly answered question; thus, with three questions, the index ranges from 0 to 3, with higher values indicating greater financial literacy.

- web_lit is a proxy for technological literacy, as measured by the answer to a question about regularly using the Internet (regular use or not – see Appendix 1). A dummy variable is used: regular users of the Internet are assigned a value of 1; non-regular users of the Internet are assigned a value of 0.
- age is the age of the head of household (the HRS survey is limited to respondents aged 50+).
- edu is the highest level of education attained by the head of household, specifically 0 representing no formal education, 1-11 representing the corresponding grade level, 12 representing high school graduate, 13-15 representing some college, 16 representing college graduate, and 17+ representing post college (see Appendix 1).
- $income$ is a continuous variable that measures the income of the household, as measured by wage and salary income before taxes and other deductions.

In all cases, the responses "Don't Know," "Not Ascertained," and "Refused" were re-coded as missing in the dataset, and therefore were not included in any multivariate regression. Due to the sensitive nature of certain questions contained in the survey regarding income and financial competence, many respondents refused to answer some or all questions, thereby reducing our sample size for multivariate analyses.

V. Results

Before examining the relationship that our two independent variables of interest – technological and financial literacy – have with stock market participation, it is useful to note some descriptive statistics about our sample. Only 22% of our sample own stock or stock mutual funds (not including IRA accounts, Keogh accounts, 401k accounts, and other similar defined contribution plans – see Table 1). Additionally, less than 55% of respondents answered all three

questions related to basic financial literacy correctly (see Table 2) and only approximately half use the Internet regularly (see Table 3). Looking a bit closer, it seems that there appears to be a correlation between education and stock market participation (see Table 4), namely the higher level of education, the higher likelihood one is to own stock. Approximately 10% of high school graduates own stock, compared with 28% of college graduates and 34% of respondents with some post-college education (see Table 4). Although education is usually interwoven with income (highly educated individuals are usually high earners) and thereby with the ability to access money to invest, the raw numbers are nonetheless suggestive of some form of relationship. Table 5 breaks down stock market participation by level of financial literacy (as determined by the number of correctly answered questions). Once again, the raw numbers are evocative: respondents with high financial literacy (who answered all three questions correctly) participated in the stock market at a rate more than double those with low financial literacy (who answered 0 or 1 questions correctly).

Yet, it is important to reiterate that caution must be exercised due to the possibility of simultaneity. Just as financial literacy could boost stock market participation, participating in the stock market could boost financial literacy. Table 6 breaks down stock market participation by level of Internet literacy. Respondents with Internet literacy (meaning that they use the Internet regularly) owned stocks at a rate double of those with no Internet literacy (31% versus 14%). Table 7 breaks down Internet use by level of formal education. As educational attainment increases, so too does the propensity to use the Internet regularly. In fact, approximately 87% of college graduates used the Internet regularly, compared to approximately 50% for high school graduates. Finally, for the sake of context, the mean of the highest educational attainment from

the sample is 12.7 years; the mean income is $44,575 and the mean age of a respondent is 65.8 years old.

Results of the linear probability model are shown in Table 8. Model 1 includes only our independent variables of interest, and the results indicate that both variables are statistically significant. Models 2-4 add demographic or socioeconomic control variables (education in Model 2, income in Model 3, age in Model 4). In Model 4, the results show that our model, which aims to control for confounding variables, yields only one statistically significant variable: income. This result should come as no surprise – as income rises, the amount of disposable income theoretically rises and the potential to invest increases.

Results of the logistic regression model with odds are shown in Table 9. Once again, as we add relevant control variables, most importantly education and income, our independent variables of interest – financial and technological literacy – become statistically insignificant. In Model 4, which includes control variables for education, income, and age, only education and income are statistically significant. Interpreting the results using an odds ratio, we can say that for every grade level increase in education, the odds of participating in the stock market (versus not participating) increases by a factor of 1.239. Since the odds for income is 1, there is no utility in pursuing any further interpretation. In other words, the odds ratio is even, at 1:1. At the roulette table, if one has even odds, the payout is simply the amount of the bet (no winners/no losers).

Overall, the results of our models using LPM and logit with odds yield intriguing takeaways. Although our independent variables of interest were not statistically significant in

either of the fully identified models, the results clearly hinted at the unsurprising conclusion that education and income are correlated with stock market participation.

VI. Discussion and Limitations

Despite the inconclusive results of this study regarding our independent variables of interest, there is certainly a great deal to uncover in future studies regarding the relationship between financial and technological literacy and stock market participation. It is important to note this study's limitations, which may have influenced the results of our analysis. First, the HRS is limited to Americans over the age of 50. Given that the data set is comprised of retirement age individuals who would not necessarily increase their stock market participation as they approach retirement and who are less likely to use the Internet to trade, the results for these two variables are most likely skewed down. If a cohort of 25-45 year olds was used instead, the results would likely be different. Second, the study is limited simply by the nature of the questions asked in the HRS. Questioning individuals about their finances, stock ownership, and certain competencies are sensitive subjects. Those who refused to answer one or several questions in the survey affect the measure of our results since missing data was excluded from our regression analyses. Third, since the HRS only asks about stock ownership other than defined contribution retirement plans, respondents could still be heavily invested in stocks through an IRA or 401k yet truthfully answer "no" to the question about whether they owned stock or stock mutual funds. It could be hypothesized, then, that the rates of stock ownership in our data are artificially low because they do not account for defined contribution plans.

Even though the regression results do not support our hypothesis about a positive relationship between financial and technological literacy and stock market participation, there are

some important conclusions. As evidenced by the tables that break down stock market participation, it seems reasonable to conclude that Americans do not invest heavily in the stock market, and that the participation rate is influenced to some degree by education and income. Moreover, even though the independent variables of interest were not statistically significant in our research, other research has found otherwise. Lusardi and Mitchell (2013) concluded that many of the financially illiterate have been shown to shun the stock market, and as is hinted at in the results, those without a college education are much less likely to grasp advanced financial concepts such as risk diversification (Lusardi & Mitchell, 2013).

VII. Conclusions and Policy Implications

Despite the fact that our empirical results did not show that financial and technological literacy have a clear relationship with stock market participation, there were hints that there may exist some sort of correlation, based on the data contained in Tables 4-7. Furthermore, the results did show, unsurprisingly, that educational attainment and income seem to interact with stock market participation. Individuals who have more formal education tend to earn more and therefore, have more disposable income to invest in the stock market.

This research supports the notion that the interaction between financial literacy, technological literacy, and stock market participation is complicated. Furthermore, on the surface, it suggests that the most significant factors in whether one participates in the stock market are fairly basic – level of education and income – not the knowledge of compound interest, inflation, and other specifically financial knowledge, as previous research has argued. If we acknowledge that the decision to participate in the stock market is not clearly influenced by financial or technological literacy, is it worthwhile to invest in literacy as a means of boosting stock market participation? Based on the results of *our* research, the answer is clearly no. Yet

there is plenty of other research showing there *is* a relationship between financial and technological literacy and stock market participation rates, as noted previously.

Alternative methods of research that could be used to examine a possible connection between financial and technological literacy and stock market participation include using aggregate data from Google searches of stocks and stock-based investment vehicles, examining the prevalence of Internet-based trading platforms (E-Trade, Scottrade, TD Ameritrade), and observing the sales data from online retailers that sell finance books and e-books. As opposed to using survey data from 2002 as we have done in this research, these alternative methods are current (and can be "refreshed" easily) and can be compared with similar searches or data, such as bonds or savings accounts. Of course, there may be privacy issues when attempting to ascertain information that is assumed to be private, but perhaps certain safeguards could be employed to ensure the information's anonymity. Although these alternative research methods are unlikely to yield the determination of a causal relationship, they could contribute to a more comprehensive understanding of a possible link.

There are plenty of reasons to pursue initiatives aimed at increasing financial and technological literacy, and these initiatives could be pursued without any premonition of their relationship to stock market participation. The fact remains that Americans are, on an aggregate level, suffering from technological and financial illiteracy, and even if increasing financial and technological literacy does not boost stock market participation (as our results indicate), they could have an effect, more generally, on economic outcomes. With the goal of increasing technological literacy, proposed policies include investing in computers and Internet access for low-income public schools, with class time devoted each day to learning about how to use these technologies, dedicated computer lab time in schools, library technology programs (in public

libraries), tablets in K-12, and community computing centers (Seattle Goodwill, 2014). As a complement, personal finance classes in low-income public schools could be implemented and/or expanded, with completion of at least one course mandated as a requirement for high school graduation. Public schools that qualify for a Title One grant are, by definition, comprised of at least 40% low-income students. Therefore, policy initiatives focusing on raising technological and financial literacy in Title One schools would target populations who have been historically left on the sidelines during the exponential growth of equity markets.

That said, pursuing initiatives aimed at increasing financial and technological literacy means that other worthwhile initiatives don't receive funding, for example, hunger, mental health, or child abuse, given the reality of limited resources. The results of our research show that the relationship between financial and technological literacy and stock market participation remains unclear. Therefore, policymakers would surely be hard pressed to see the rationale behind investing in initiatives for increasing financial and technological literacy as a means to boost stock market participation rates. And it may even seem like a waste of time to devote resources to initiatives aimed at increasing our reliance on equity markets. But if future research focuses on economic outcomes as the dependent variable, as opposed to stock market participation (which could be argued is a component of economic outcome), the results could prove to be more conclusive. There is also the chronic policy option of doing nothing, which is easily defensible since supporters of the status quo are rarely hard to find.

Notwithstanding the murky takeaways of this research, if policymakers make the leap and decide to invest resources in increasing financial and technological literacy (whether or not they are linked with stock market participation), choosing which policy interventions should be adopted is challenging, since there has been no carefully-crafted cost-benefit analysis indicating

which sorts of programs are most appropriate, and least expensive, for which kinds of people (Lusardi and Mitchell, 2013). Indeed, Hastings, Madrian, and Skimmyhorn (2012) have noted the while financial literacy is a serious issue, the policy prescription to ameliorate it is fraught with disagreement. Although financial education is an appealing offensive against financial illiteracy, the authors note that "the causality in these relationships is inherently difficult to pin down" (Hastings, Madrian, and Skimmyhorn, 2012). Does financial literacy translate into better economic outcomes? Or do certain types of economic behavior influence financial literacy? Or do other factors, for example patience or interest in finance, boost financial literacy and/or financial outcomes? (Hastings, Madrian, and Skimmyhorn, 2012). The authors conclude that the evidence that financial education increases financial literacy is "more limited and not as encouraging as one might expect" (Hastings, Madrian, and Skimmyhorn, 2012).

Instead of using financial education as the mechanism to increase financial literacy, one researcher has suggested "a better public policy response to consumer finance problems might be to support pro bono expert financial advisors" (Willis, 2009). Willis' policy response addresses critiques (*See* Lusardi and Mitchell, 2013) that financial advisors do not have a fiduciary responsibility to their client, only to their firm. According to Willis, "[p]olicymakers throw mandatory financial education and counseling at problems of bankruptcy and home mortgage foreclosures without proof that the education will help" (2009). Other researchers have picked up Willis' opinion that specialization in the form of financial advisors may be better than financial education for the masses. Hastings, Madrian, and Skimmyhorn (2012) note that "specialization in financial expertise may be efficient if it allows computational and educational investment to be concentrated or aggregated in specialized individuals or entities that develop algorithms and methods to guide consumers through financial waters." Willis has not yet

expanded her idea of pro bono financial advisors, and she admits that enforcing quality and integrity standards on advisors would be costly, but the proposed policy remains an interesting option.

Willis also advocates for increasing regulation as a means to increasing financial literacy. She notes that often, "[w]hen consumers find themselves in dismal financial straits, the regulation-through-education model blames them for their plight, shaming them and deflecting calls for effective market regulation" (Willis, 2008). Moreover, the belief in the effectiveness of financial literacy education "is implausible, given the velocity of change in the financial marketplace, the gulf between current consumer skills and those needed to understand today's complex non-standardized financial products, the persistence of biases in financial decision making, and the disparity between educators and financial-services firms in resources with which to reach consumers" (Willis, 2008). Additional regulation of financial markets would surely be met with political resistance, but "[t]he variety, complexity, and sheer number of products available in the marketplace would…be reduced" (Willis, 2009) potentially simplifying the financial decisions consumer make daily.

There is also the issue of directionality between stock market participation and our independent variables of interest, which merits a brief discussion about the role of incentives. As noted earlier, the associations between stock market participation and financial and technological literacy should not be interpreted as causal since the direction of the relationship is not clear. Just as one could choose to invest in the stock market because he or she is financially literate, one could also be gifted or furnished (perhaps by the government) with stocks, thereby potentially sparking his or her interest in finance, begetting the desire to seek additional knowledge of economics, finance, etc. and ultimately resulting in the possibility of boosting

financial literacy. In other words, it could be possible to incentivize financial literacy by providing consumers with stocks. Once they own stock, it is possible that they will take an interest in the stock market, which exposes them to an array of components central to financial knowledge. In this way, a policy option aimed at boosting financial literacy could be piloted by the government giving every American a specific amount of money in a stock mutual fund at birth.

In fact, George W. Bush proposed giving Americans the option of investing a small portion of their Social Security dollars in the stock market. Ultimately, the proposal fizzled out, but the rationale was compelling – giving Americans increased ownership and discretion with their Social Security dollars. Americans would be given an incentive to take an interest in finance, since part of their retirement would be subject to the ebbs and flows of the market. Conducting a grand experiment to see how consumer behavior and financial literacy changes when consumers have "skin in the game" would certainly yield interesting results, but as Bush learned, the policy change would be hard to achieve politically.

Regardless of the method employed to increase financial literacy, the estimated aggregate costs of financial illiteracy point to possibly high returns, especially in the areas of consumer debt and debt management (Lusardi and Mitchell, 2013). For example, when workers are carrying credit card debt or high-interest mortgages, it is usually more sensible to pay off these debts rather than raise their pension contributions. A basic knowledge of how interest rates function would likely increase the likelihood of consumers making the sensible choice. Additionally, a simple yet powerful change in defined contribution plans has had powerful effects, influenced by research into behavioral economics. Currently, many organizations automatically enroll employees in defined contribution plans, so an employee must opt-out.

Putting the impetus on the employee to opt-out takes advantage of humans' natural affinity to inertia (Benartzi and Thaler, 2013). Boosting individuals' annual savings rate – especially when they may not even miss the money – could go a long way in shoring up retirement funds.

Recently, and especially after the Great Recession, the White House and politicians have started to focus more on how to increase financial and technological literacy. Even though the Obama administration has rejected calls for financial education mandates, it is working on developing a competitive grant program which would allow schools to compete for grant money aimed at developing financial education programs. Moreover, the recently enacted Wall Street Reform and Consumer Protection Act includes financial education provisions, within the Bureau of Consumer Protection. There will be an Office of Financial Education, which includes resources on financial counseling, information about ways to plan and save money, and activities to help Americans reduce debt and build wealth (Harnisch, 2010).

Pondering whether financial and technological literacy are public goods – non-rivalrous and non-excludable according to a strict economic definition – is informative since it encourages us to think about the government's role in increasing literacy, if any. When one "consumes" financial literacy, it is reasonable to think that that act does not impede on another's ability to consume it, and also that it is impossible to exclude one from consuming it. Certainly, one could argue that wealthier people can more easily access the resources that may lead to increased financial and technological literacy – computers, fast internet access, financial advisors, etc. – but most if not all of these tools can be accessed (at some level) by Americans of simple means.

In thinking about boosting financial and technological literacy as a policy in the public's best interest, it is useful to note that one's financial and technological illiteracy can hurt everyone, much like one's poor health can have larger economic effects. Less than a decade ago,

the damage that the Great Recession caused was undoubtedly exacerbated by Americans' financial illiteracy. As Lusardi and Mitchell (2013) note, the least financially literate were more likely to sell assets that had lost value, thus locking in losses. Even if the least educated never invest again and let their knowledge endowment depreciate, they still will earn higher returns on their saving, which generates a substantial welfare boost (Lusardi & Mitchell, 2013).

With many Americans unable to grasp basic financial concepts, there have been calls to mandate personal finance courses in more states. Currently, only 15 states require a course in personal finance (Harnisch, 2010). And with many of the most accessible financial tools available on the Internet, Americans could learn how to interact with technology and thereby make use of the wealth of free information available online. As one researcher clamored, "the study of technology should be an essential part of every student's basic education" (Dugger, 2001).

Whether one is discussing financial or technological literacy, they both require "cognitive knowledge and skills and a well-calibrated degree of psychological confidence in that knowledge and those skills" (Willis, 2009). This is especially true when financial and technological literacy are being discussed in relation to investing in the stock market. After all, investing in the stock market is a bet. Giving individuals the tools to engage with and navigate the Internet and the knowledge of financial principles as conduits to shore up Americans' financial outcomes is a lofty idea on paper, but there could certainly be setbacks. Torngren and Montgomery have noted that "people with a high degree of perceived expertise in the area of a general knowledge question are likely to have unrealistically high expectations of the probability of answering correctly" (2004), and this leads to overconfidence that "can cause excessive trading, which can be risky to financial well being" (Torngren and Montgomery, 2004).

Furthermore, there is substantial heterogeneity in both financial knowledge and economic behavior (Lusardi and Mitchell, 2013), therefore, policy initiatives will not ensure stable fiscal health for everyone. Recently, there has been an increasing amount of research into the differences between theoretical models and what occurs in the real world. Researchers and policymakers have begun to push for additional insights into the gaps between modeling and reality, so as to better evaluate where the theory can be enriched, and how policy efforts can be better targeted (Lusardi and Mitchell, 2013).

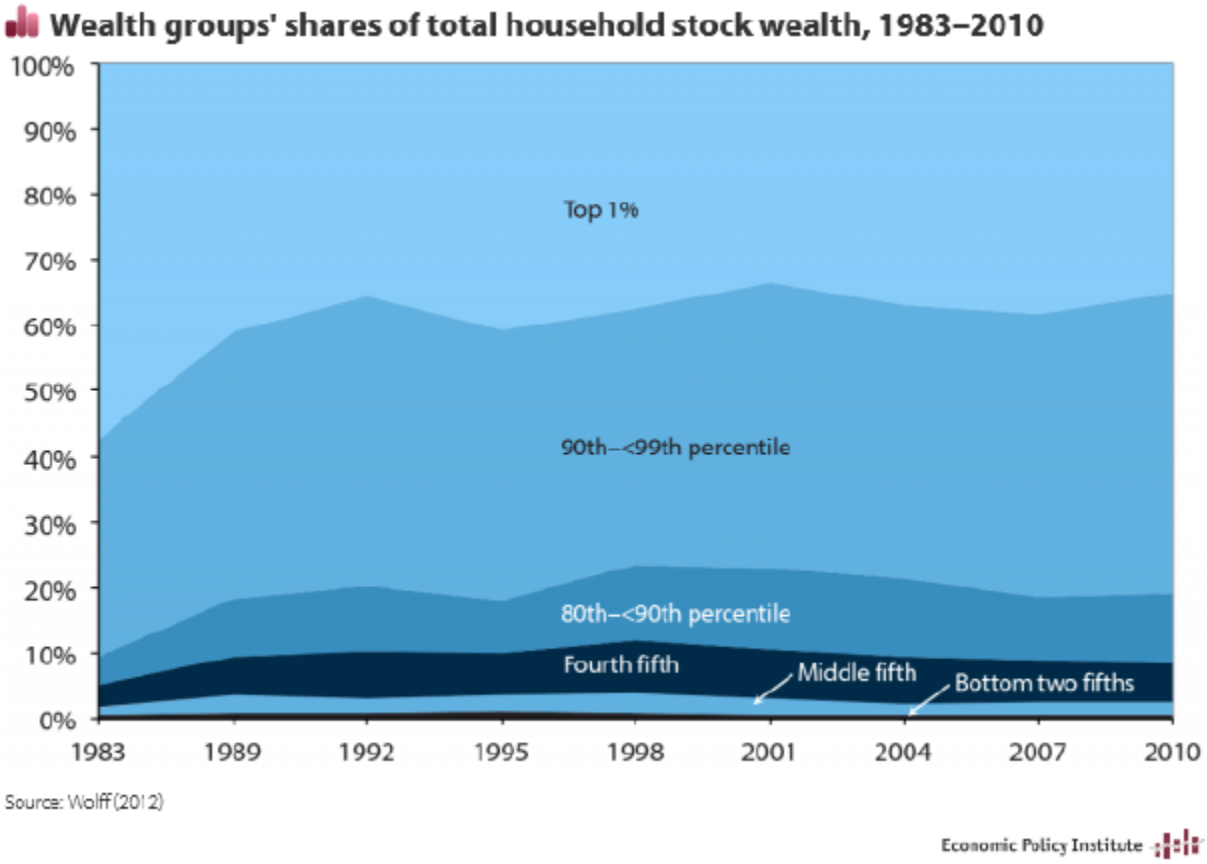
Despite the various policy prescriptions to bettering Americans' fiscal health, there is consensus on the fact that the current state of preparedness for financial decisions needs improvement. To make matters worse, research has shown that "there is little evidence that firms act to debias consumers through informative advertising or investments in financial education" (Hastings, Madrian, and Skimmyhorn, 2012), choosing rather to "exploit rather than offset consumer shortcomings" (Hastings, Madrian, and Skimmyhorn, 2012).

To shield consumers from predatory schemes, there are "ways to deliver educational content that could improve financial decision making: internet-based instruction, podcasts, web sites, games, apps…" (Hastings, Madrian, and Skimmyhorn, 2012). In this way, financial literacy is aided and made more efficient by technological literacy. Although there are a few different levers that are available to engage with the issue of insufficient wealth, the fact remains that "financial literacy is in short supply and increasing the financial capabilities of the population is a desirable and socially beneficial goal" (Hastings, Madrian, and Skimmyhorn, 2012).

The Dodd-Frank Act, which was adopted in response to the Great Recession, aims in part to protect consumers from the increasingly complex financial marketplace. Likewise, the idea of

simplifying choices for consumers, as with the automatic enrollment in a firm's retirement plan, could be options in improving America's financial health, but the risk is that choosing for Americans too much belittles the importance of individuals making active choices and sound decisions through deliberation. Ultimately, it is up to policymakers to decide how Americans right the ship toward a funded retirement, and navigate the often treacherous waters of the financial world. However it is achieved, equipping folks with the tools to plan more, ask more questions, take more sensible risks, teach and pass along knowledge, and above all have confidence in their ability to judge prudently when making financial decisions is a policy matter that requires urgent thought and increased attention. It remains to be seen if financial and technological literacy, as well as stock market participation, are components of subsequent policy initiatives addressing these economically pressing needs.

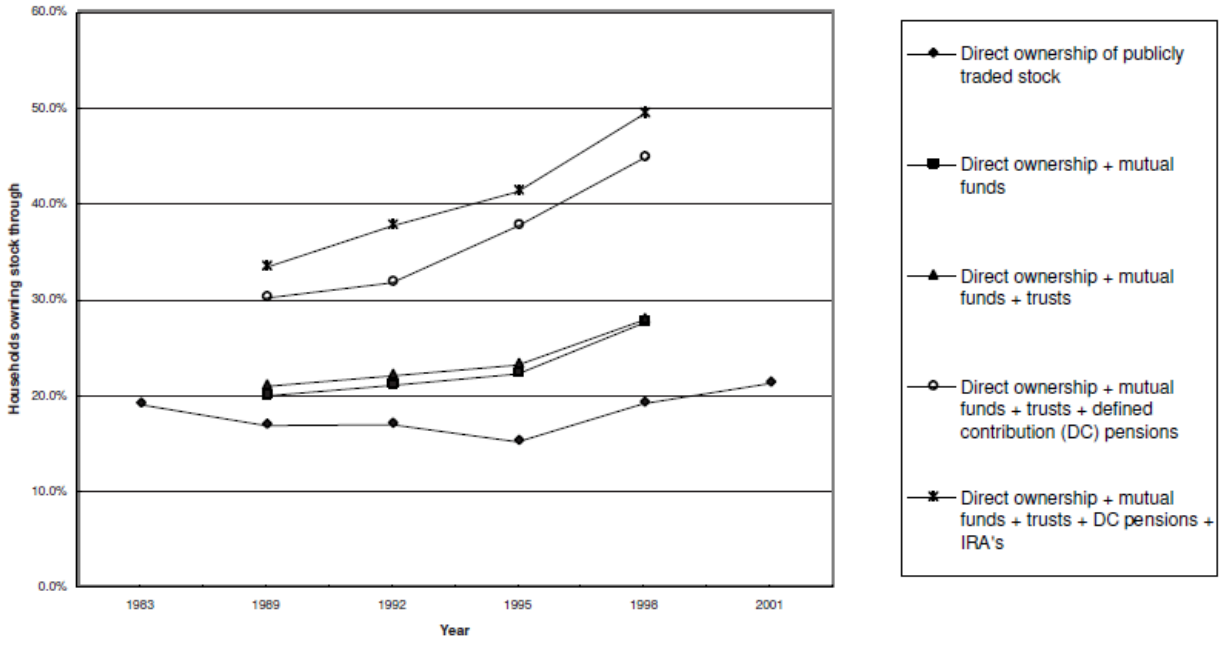
Figure 1



Source: Wolff, 2012

Figure 2

Figure 1: Percent of U.S. Households Owning Stock, 1983 - 1998



Source: Bogan, 2008

Table 1

Participates in stock market	Frequency	Percent
No	16,487	77.86
Yes	4,689	22.14
Total	21,176	100

Table 2

Financial Literacy	Frequency	Percent
0	24	1.65
1	169	11.65
2	467	32.18
3	791	54.51
Total	1,451	100

Table 3

Web Literacy	Frequency	Percent
No	11,288	51.98
Yes	10,428	48.02
Total	21,716	100

Table 4

Highest Level of Education	Participates in stock market		
	No	Yes	Total
No formal education	33	0	33
1st Grade	17	0	17
2nd Grade	35	1	36
3rd Grade	52	0	52
4th Grade	41	0	41
5th Grade	38	2	40
6th Grade	191	3	194
7th Grade	42	3	45
8th Grade	97	1	98
9th Grade	166	5	171
10th Grade	187	6	193
11th Grade	312	8	320
High School Graduate	1490	169	1659
College Freshman	436	74	510
College Sophomore	704	131	835
College Junior	252	45	297
College Graduate	616	241	857
Post College	385	196	581
Total	5094	885	5979

Table 5

Financial Literacy	Participates in stock market		
	No	Yes	Total
0	22	1	23
1	141	24	165
2	385	71	456
3	535	243	778
Total	1083	339	1422

Table 6

Web Literacy	Participates in stock market		
	No	Yes	Total
No	9413	1539	10952
Yes	7016	3138	10154
Total	16429	4677	21106

Table 7

Highest Level of Education	Web Literacy		
	No	Yes	Total
No formal education	30	2	32
1st Grade	13	5	18
2nd Grade	35	3	38
3rd Grade	49	5	54
4th Grade	38	3	41
5th Grade	38	3	41
6th Grade	193	11	204
7th Grade	40	4	44
8th Grade	81	21	102
9th Grade	140	35	175
10th Grade	143	53	196
11th Grade	243	81	324
High School Graduate	854	846	1700
College Freshman	166	364	530
College Sophomore	229	625	854
College Junior	76	230	306
College Graduate	114	766	880
Post College	43	550	593
Total	2525	3607	6132

Table 8

Variable	LPM Model 1 (95% CI)	LPM Model 2 (95% CI)	LPM Model 3 (95% CI)	LPM Model 4 (95% CI)
Financial Literacy	0.075*** (0.046, 0.105)	0.061* (0.015, 0.107)	0.039 (-0.024, 0.103)	0.040 (-0.024, 0.103)
Web Literacy	0.141*** (0.095, 0.186)	0.088* (0.009, 0.166)	0.026 (-0.090, 0.141)	0.026 (-0.090, 0.142)
Education		0.021*** (0.010, 0.033)	0.015 (-0.001, 0.032)	0.015 (-0.001, 0.032)
Income			2.17e-06* (9.14e-07, 3.43e-06)	2.17e-06* (9.08e-07, 3.43e-06)
Age				-0.0004 (-0.011, 0.010)

Note: CI = confidence interval. In Model 1, n = 1422; in Model 2, n = 432, and in Models 3-4, n = 274.

*P<0.05; ***P<0.001

Table 9

Variable	Logit Model 1, OR (95% CI)	Logit Model 2, OR (95% CI)	Logit Model 3, OR (95% CI)	Logit Model 4, OR (95% CI)
Financial Literacy	1.680*** (1.371, 2.057)	1.897* (1.127, 3.193)	1.646 (0.843, 3.214)	1.647 (0.843, 3.217)
Web Literacy	2.350*** (1.767, 3.115)	3.013* (1.216, 7.462)	1.911 (0.524, 6.973)	1.914 (0.524, 6.990)
Education		1.327*** (1.149, 1.532)	1.240* (1.026, 1.499)	1.239* (1.025, 1.499)
Income			1.000* (1.000, 1.000)	1.000* (1.000, 1.000)
Age				1.003 (0.915, 1.099)

Note: CI = confidence interval; OR = odds ratio. In Model 1, n = 1422; in Model 2, n = 432, and in Models 3-4, n = 274.

*P<0.05; ***P<0.001

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MB014                          R HIGHEST LEVEL OF EDUCATION
         Section: B     Level: Respondent      Type: Numeric    Width: 2   Decimals: 0
         Ref: SecB.School.B014_


         What is the highest grade of school or year of college you completed?

         0......For no formal education
         1-11.....Grades
         12........High school
         13-15....Some college
         16........College grad
         17........Post college (17+ years)
         97........Other


.....................................................................................
            41                        0.  For no formal education
          1285                      1-11.  Grades
          1743                        12.  High school
          1769                     13-15.  Some college
           916                        16.  College grad
           623                        17.  Post college (17+ years)
            52                        97.  Other
            21                        98.  DK (Don't Know); NA (Not Ascertained)
                                      99.  RF (Refused)
         15584                     Blank.  INAP (Inapplicable); Partial Interview



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MQ316                          STOCK AND STOCK MUTUAL FUNDS
         Section: Q     Level: Household       Type: Numeric    Width: 1   Decimals: 0
         Ref: SecQ.StockAssetIncome.Q316_StockAssets

         Aside from anything you have already told me about, do you [or your]
         [husband/wife/partner] have any shares of stock or stock mutual funds?


.....................................................................................
          2972           1.  YES
         11645           5.  NO
           125           8.  DK (Don't Know); NA (Not Ascertained)
           192           9.  RF (Refused)
           346       Blank.  INAP (Inapplicable); Partial Interview
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- -

MQ020 R AMOUNT FROM WAGES AND SALARY LCY

Section: Q Level: Household Type: Numeric Width: 8 Decimals: 0

Ref: SecQ.RIncome.Q020_RAMTWAGESALLCY

About how much wage and salary income did you receive in [Last Calendar Year], before taxes and other deductions?

Do not probe DK/RF

Amount:

.....

N	Min	Max	Mean	SD	Miss
4597	0	1400000	43048.05	48072.60	9994

376	99999998.	DK (Don't Know); NA (Not Ascertained)
313	99999999.	RF (Refused)

- -

MV351 100DOLLARS 2PERCENT-INTEREST 5 YRS

Section: V Level: Respondent Type: Numeric Width: 1 Decimals: 0

Ref: SecV.MOD8.V351_Interest

The next questions are about money and investments.

First, suppose you had $100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow -- more than $102, exactly $102, or less than $102?

.....

1301	1.	MORE THAN $102
253	2.	EXACTLY $102
190	3.	LESS THAN $102
81	8.	DK (Don't Know); NA (Not Ascertained)
12	9.	RF (Refused)
20197	Blank.	INAP (Inapplicable); Partial Interview

- -

MV352 MONEY BUY MORE SAME LESS THAN TODAY

Section: V Level: Respondent Type: Numeric Width: 1 Decimals: 0

Ref: SecV.MOD8.V352_Inflation

Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, would you be able to buy more than today, exactly the same as today, or less than today with the money in this account?

....

105	1.	MORE THAN TODAY
163	2.	EXACTLY THE SAME AS TODAY
1495	3.	LESS THAN TODAY
63	8.	DK (Don't Know); NA (Not Ascertained)
11	9.	RF (Refused)
20197	Blank.	INAP (Inapplicable); Partial Interview

- -

MV353 SINGLE CO STOCK SAFER THAN MUTUAL FUND

Section: V Level: Respondent Type: Numeric Width: 1 Decimals: 0

Ref: SecV.MOD8.V353_Saferreturn

Do you think that the following statement is true or false: buying a single company stock usually provides a safer return than a stock mutual fund?

....

318	1.	TRUE
1181	5.	FALSE
326	8.	DK (Don't Know); NA (Not Ascertained)
12	9.	RF (Refused)
20197	Blank.	INAP (Inapplicable); Partial Interview

- -

MW303 REGULAR USE OF WEB FOR EMAIL

Section: W Level: Respondent Type: Numeric Width: 1 Decimals: 0

Ref: EventHistory.W303_

Do you regularly use the World Wide Web, or the Internet, for sending and receiving e-mail or for any other purpose, such as making purchases, searching for information, or making travel reservations?

....

10428	1.	YES
11288	5.	NO
14	8.	DK (Don't Know); NA (Not Ascertained)
25	9.	RF (Refused)
279	Blank.	INAP (Inapplicable); Partial Interview

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